

## FACTORS ASSOCIATED WITH IMMEDIATE ABORTION COMPLICATIONS

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### Abstract • Résumé

**Objective:** To identify factors associated with increased risk of immediate complications from induced abortion.

**Design:** Retrospective analysis of a provincial database.

**Setting:** All Ontario general hospitals in which abortions are performed and all free-standing abortion clinics in Ontario.

**Population:** Women in Ontario aged 15 to 44 years who underwent an induced abortion in the province (without concurrent sterilization) between Jan. 1, 1992, and Dec. 31, 1993.

**Outcome measures:** Recording of complications at the time of the procedure; gestational age, type of procedure, place of abortion (hospital or clinic), and patient's age, parity and history of previous abortion (spontaneous or induced).

**Results:** During the study period 83 469 abortions were performed that met our inclusion criteria. Immediate complications were reported in 571 cases (0.7%). Multivariate logistic regression analysis revealed that, after other variables were controlled for, the patient's age, parity and history of previous abortions (spontaneous or induced) were not significant risk factors for immediate complications; however, gestational age, method of abortion and place of abortion were significant risk factors ( $p < 0.001$ ). The odds ratio (OR) for having a complication from abortion was 1.3 (95% confidence interval [CI] 1.02 to 1.63) between 9 and 12 weeks, compared with having one after abortion at 9 weeks or earlier, and increased to 3.3 (95% CI 2.23 to 5.00) after abortion between 17 and 20 weeks. Compared with surgical dilatation and curettage (D&C), instillation of saline and instillation of prostaglandins were more likely to be associated with immediate complications (OR 24.0, 95% CI 13.22 to 43.70, and OR 11.7, 95% CI 6.43 to 21.18, respectively), whereas both suction D&C and insertion of a laminaria tent were less likely to be associated with immediate complications (OR 0.4, 95% CI 0.26 to 0.67, and OR 0.3, 95% CI 0.19 to 0.52, respectively). Compared with women who had an abortion in a free-standing clinic, the risk for immediate complications was greater among those who had an abortion in a hospital, especially a teaching hospital (OR 1.9, 95% CI 1.38 to 2.58), a nonteaching hospital with 200 to 399 acute care beds (OR 3.1, 95% CI 2.27 to 4.21) and a nonteaching hospital with fewer than 200 acute care beds (OR 5.9, 95% CI 4.04 to 8.64).

**Conclusion:** The risk of immediate complications from induced abortion is very low. Unlike in previous studies, the woman's age, parity and history of previous spontaneous or induced abortions were not found to be risk factors. However, advancing gestational age and procedures involving instillation of saline or prostaglandins were predictive factors of immediate complications.

**Objectif :** Identifier les facteurs liés à un risque accru de complications immédiates à la suite d'un avortement provoqué.

**Conception :** Analyse rétrospective d'une base de données provinciale.

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**Contexte :** Tous les hôpitaux généraux de l'Ontario où l'on pratique des avortements et toutes les cliniques autonomes d'avortement de l'Ontario.

**Population :** Femmes de l'Ontario âgées de 15 à 44 ans qui ont subi un avortement provoqué dans la province (sans stérilisation concurrente) entre le 1<sup>er</sup> janv. 1992 et le 31 déc. 1993.

**Mesures des résultats :** Consignation des complications au moment de l'intervention, âge de la grossesse, type d'intervention, lieu de l'avortement (hôpital ou clinique) et âge de la patiente, parité et avortements antérieurs (spontanés ou provoqués).

**Résultats :** Au cours de la période d'étude, on a pratiqué 83 469 avortements qui ont satisfait aux critères d'inclusion. On a signalé des complications immédiates dans 571 cas (0,7 %). L'analyse de régression logistique à variables multiples a révélé que, toutes les autres variables étant contrôlées, l'âge de la patiente, la parité et les avortements antérieurs (spontanés ou provoqués) ne constituaient pas des facteurs significatifs de risque de complications immédiates. L'âge de la grossesse, la méthode d'avortement et le lieu où a été pratiqué l'avortement étaient toutefois des facteurs de risque significatifs ( $p < 0,001$ ). Par rapport au risque de complications suite à un avortement à la neuvième semaine ou avant, le ratio des probabilités [RP] de complications entre la neuvième et la douzième semaines était de 1,3 (intervalle de confiance [IC] à 95 %, 1,02 à 1,63), et augmentait à 3,3 (IC à 95 %, 2,23 à 5,00) suite à un avortement entre la dix-septième et la vingtième semaines. Comparativement au curetage, l'instillation de solution physiologique et l'instillation de prostaglandines avaient plus de chance d'être liées à des complications immédiates (RP 24,0, IC à 95 %, 13,22 à 43,70, et RP 11,7, IC à 95 %, 6,43 à 21,18, respectivement), tandis que le curetage par succion et l'insertion d'une laminaire avaient moins de chance d'être liés à des complications immédiates (RP 0,4, IC à 95 %, 0,26 à 0,67, et RP 0,3, IC à 95 %, 0,19 à 0,52, respectivement). Comparativement aux femmes qui ont subi un avortement dans une clinique autonome, le risque de complications immédiates était plus élevé chez celles qui ont subi un avortement dans un hôpital, et particulièrement dans un hôpital d'enseignement (RP 1,9, IC à 95 %, 1,38 à 2,58), dans un hôpital autre qu'un hôpital d'enseignement comptant de 200 à 399 lits pour soins actifs (RP 3,1, IC à 95 %, 2,27 à 4,21) et dans un hôpital autre qu'un hôpital d'enseignement comptant moins de 200 lits de soins actifs (RP 5,9, IC à 95 %, 4,04 à 8,64).

**Conclusion :** Le risque de complications immédiates causées par un avortement provoqué est très faible. Contrairement aux résultats d'études antérieures, on n'a pas constaté que l'âge de la femme, la parité et les avortements spontanés ou provoqués antérieurs constituaient des facteurs de risque. L'avancement de la grossesse et des interventions comportant l'instillation de solution physiologique ou de prostaglandines constituaient toutefois des prédicteurs de complications immédiates.

Several studies have examined the risk of major medical postoperative complications from induced abortions. In a large study of 170 000 first-trimester abortions performed in three free-standing clinics in New York City the overall complication rate was 9.05 per 1000 abortions.<sup>1</sup> In 0.71 per 1000 cases the woman had to be admitted to hospital (because of perforation, ectopic pregnancy, hemorrhage, sepsis or recognized incomplete abortion), and in 8.46 per 1000 minor complications occurred (usually mild infection).

Suction dilatation and evacuation (D&E) is the safest method for termination of second-trimester pregnancies. Grimes and associates<sup>2</sup> noted a significantly lower complication rate among 6213 women who underwent abortion by D&E than among those who underwent abortion by intra-amniotic instillation of saline during the 13th to the 20th week of pregnancy. Grimes and Schultz<sup>3</sup> noted that in the United States the relative risk of serious complications associated with intra-amniotic instillation of urea and prostaglandin  $F_{2\alpha}$  ( $PGF_{2\alpha}$ ) was 1.9 times that associated with D&E and that this instillation method was safer than hysterotomy and hysterectomy. Cates and collaborators<sup>4</sup> reported that D&E was more than 160% safer than instillation of saline, which they found to be

60% safer than instillation of  $PGF_{2\alpha}$  ( $p < 0.01$ ). These results were supported by Peterson and colleagues,<sup>5</sup> who found that among 11 747 women the complication rate was lower among those who underwent abortion by D&E than among those who underwent abortion by instillation of saline or prostaglandins. They also found that abortions by D&E were quicker and were performed through 21 weeks' gestation without a significant increase in the complication rate.<sup>5</sup>

Some researchers have found that second-trimester abortion by D&E is associated with a higher risk of complications when performed with general anesthesia than with local anesthesia.<sup>6,7</sup> However, in their review of 170 000 first-trimester abortions, Hakim-Elahi, Tovell and Burnhill<sup>1</sup> found no significant difference in the complication rates among women given a general anesthetic and those given a local anesthetic.

Some have noted that the risk of complications increases with the length of gestation.<sup>4,8</sup> In a review of data from Canada, Denmark, England and Wales, Germany and New York State, Henshaw<sup>8</sup> found that 0.4% to 3.4% of first-trimester abortions were associated with complications, as compared with 1.1% to 8.7% of second-trimester abortions. Cates and collaborators<sup>4</sup> showed

that any delay increased the risk of complications and that this increase was continuous and linear. Buehler and coworkers<sup>9</sup> observed an increased risk of serious complications from induced abortion that was due to other factors associated with gestational age: a history of previous induced abortion was associated with serious complications among women undergoing abortion during the first 12 weeks' gestation, whereas advancing age of the woman and advancing gestational age were associated with an increased risk among those undergoing abortion after 12 weeks' gestation. The rate of serious complications increased gradually during the first trimester, after which there was a sharp increase (relative risk for a 2-week increment 1.50, 95% confidence interval [CI] 1.43 to 1.57).

Relatively few Canadian data are available. Abortion is a medical procedure regulated under the Canada Health Act, and therefore there is an implicit obligation to monitor quality of care. In a recent study in Quebec Jacot and associates<sup>10</sup> reviewed the charts of women who had undergone either first-trimester abortion by suction curettage (2908 women) or second-trimester abortion by D&E (477). They found that the complication rate did not differ significantly between the two groups. Their results suggest that second-trimester abortions may be performed safely by D&E under local anesthesia.

To add to the Canadian data, we reviewed the charts of abortions performed in Ontario in 1992 and 1993 to determine factors associated with complications occurring at the time of abortion.

## METHODS

### DATABASE

For our study we defined abortion as any procedure performed with the intent to terminate pregnancy and therefore excluded spontaneous and incomplete abortions. We identified abortion-related complications through the Ontario Ministry of Health's Abortion Registry Database, which contains information from monthly standardized reports submitted by hospitals and free-standing abortion clinics. In a previous study we showed that the registry data can be used with confidence.<sup>11</sup>

Since the present system for identifying complications includes only those recognized at the time of the procedure, we assumed that hospitals and clinics were equally likely to identify cases requiring subsequent intervention. We were reasonably confident that hospital patients would not stay long enough to register more complications than patients in clinics would and thus create an ascertainment bias. The Abortion Registry Database uses continuous data to describe length of stay,

but we grouped the data into 0 days (for outpatient care), 1 day or less, or more than 1 day.

There are two main categories of abortion methods: instrumental evacuation of the uterus (e.g., surgical or suction dilatation and curettage [D&C]) and induction of labour. The latter involves the administration of an abortifacient (e.g., hypertonic saline, urea or prostaglandin) through intra-amniotic or extraovular injection. An osmotic dilator (laminaria tent) may be used before either type of procedure to achieve adequate cervical dilation.

Table 1 lists the initial procedures performed in Ontario in 1992 and 1993 recorded in the Abortion Registry Database. The database classified all procedures

**Table 1: Initial procedures, and their components, used to perform induced abortions in Ontario in 1992 and 1993\***

Initial procedure and components†	% of abortions
<b>Surgical dilatation and curettage (D&amp;C)</b>	<b>1.27</b>
Alone	1.02
With suction D&C	0.25
<b>Suction D&amp;C</b>	<b>66.28</b>
Alone	60.93
With surgical D&C	5.33
<b>Hysterotomy</b>	<b>0.00</b>
<b>Hysterectomy</b>	<b>0.00</b>
<b>Instillation of saline</b>	<b>0.39</b>
Alone	0.22
With surgical D&C	0.01
With suction D&C	0.00
With insertion of laminaria tent	0.16
<b>Instillation of urea</b>	<b>0.03</b>
Alone	0.00
With instillation of prostaglandins	0.03
With insertion of laminaria tent	0.00
<b>Instillation of prostaglandins</b>	<b>0.54</b>
Alone	0.33
With surgical D&C	0.02
With suction D&C	0.04
With instillation of saline	0.03
With insertion of laminaria tent	0.12
<b>Insertion of laminaria tent</b>	<b>31.49</b>
Alone	0.02
With surgical D&C	4.92
With suction D&C	26.27
With instillation of prostaglandins	0.27
<b>Other</b>	<b>0.02</b>

\*Data were obtained from the Abortion Registry Database of the Ontario Ministry of Health.

†The various components were not examined separately; therefore, the main variable for procedure type is the initial procedure, which includes a combination of all the components listed for that procedure.

performed to terminate a pregnancy and the sequence in which they occurred. Although listed in the database, instillation of urea (27 cases), hysterotomy (1 case) and hysterectomy (1 case) were eliminated from further analysis because of low numbers. We ensured that all subsequent surgical procedures were recorded only in association with a complication. Individual components of the abortion procedure were not examined separately. Instead, we grouped the data by the components and used the primary procedure (surgical D&C, suction D&C, instillation of saline, instillation of prostaglandins and laminaria tent) to identify the type of procedure. Although some may argue for grouping instillation of saline, instillation of prostaglandins and laminaria tents as components of an evacuation procedure, this would have prevented us from being able to examine the effects of these techniques on immediate complications. By grouping the data as we did, we could, for example, compare suction D&C in combination with a laminaria tent and suction D&C alone.

## CASE SELECTION

We obtained data on cases registered in the database in 1992 and 1993. We chose 1992 as the beginning of the study period because it was the first full year of mandatory reporting by Ontario hospitals and free-standing abortion clinics. We excluded cases for which the records were incomplete or had out-of-province residence codes. Cases involving concurrent sterilization were excluded because we were unable to attribute complications solely to the abortion procedure. We selected only cases in which the woman was 15 to 44 years of age. This age range is most commonly used in pregnancy outcome analysis; inclusion of the likely low numbers of younger or older women would introduce bias in the analysis.

## STATISTICAL ANALYSIS

We used logistic regression analysis to examine the association between risk factors and subsequent medical complications. From a literature review we identified variables categorized as risk factors for a major complication and included them in the model. Univariate regression analysis was initially performed, and crude odds ratios (ORs) were calculated for each variable. Subsequently we used multivariate logistic regression analysis with the backward selection technique. In backward stepwise regression analysis, all variables considered potential factors are initially entered into the full model; those with the smallest contribution to the model are then removed one at a time until all remaining variables contribute significantly.<sup>12</sup> Only variables found to be sta-

tistically significant at a *p* value of less than 0.05 were included in the final model. The effect of each variable on the risk of complications was expressed as an adjusted OR with a 95% CI.

The outcome variable was the recording of any of the

**Table 2: Characteristics of Ontario women who underwent induced abortions in the province in 1992 and 1993**

Characteristic	% of women <i>n</i> = 83 469
<b>Age, yr</b>	
10-14	0.5
15-19	18.8
20-24	30.3
25-29	24.0
30-34	16.1
35-39	8.1
40-44	2.2
45-49	0.1
<b>Marital status</b>	
Married	22.8
Not married	76.3
Unknown	0.9
<b>Gestational age, wk</b>	
< 9	39.4
9-12	47.3
13-16	7.7
17-20	2.7
> 20	0.2
Unknown	2.7
<b>Parity</b>	
0	53.0
1	20.5
2	14.5
> 2	5.9
Unknown	6.1
<b>No. of previous induced abortions</b>	
0	62.1
1	22.6
2	5.8
> 2	2.0
Unknown	7.5
<b>No. of previous spontaneous abortions</b>	
0	85.3
1	5.4
2	1.0
> 2	0.3
Unknown	8.0

complications, at the time of the procedure, listed on the standardized reporting form: hemorrhage (of 500 mL or more), laceration of the cervix, perforation of the uterus, retained product of conception, maternal death, infection or other (unspecified).

The independent variables were gestational age (less than 9 weeks, 9 to 12 weeks, 13 to 16 weeks, 17 to 20 weeks or more than 20 weeks); type of procedure; place of abortion (hospital or free-standing abortion clinic; we categorized hospitals according to their size and type, adhering to standard provincial practice of categorizing by peer groupings: all member hospitals of the Ontario Council of Teaching Hospitals [OCOTH] were grouped in one category and non-OCOTH hospitals were divided into three groups based on the number of acute-care beds [400 or more, 200 to 399 and fewer than 200]); patient's age; parity (none v. one or more); history of previous induced abortion (none v. one or more); and history of previous spontaneous abortion (none v. one or more).

## RESULTS

### PATIENT CHARACTERISTICS

Of 88 127 abortions performed in 1992 and 1993, 83 469 met our inclusion criteria. The distribution by facility type was 32.4% in clinics, 32.8% in teaching hospitals and 34.7% in nonteaching hospitals. The distribution in nonteaching hospitals of 400 or more beds, 200 to 399 beds and fewer than 200 beds was 6.3%, 24.2% and 4.2% respectively. Table 2 presents a summary of selected characteristics of the study population. In 1992 and 1993 most of the women were unmarried, were between 20 and 29 years of age and had no reported previous deliveries.

### LENGTH OF STAY

Of the 83 469 women, all who underwent an abortion in a clinic and 93.8% of those who underwent one in a hospital were outpatients. Of the remaining women 5.1% stayed in hospital 1 day or less, and 1.1% stayed longer than 1 day.

### ABORTION CHARACTERISTICS

Table 3 shows the proportion of abortions by facility type and gestational age. Clinics performed more second-trimester abortions than did hospitals (15.5% v. 8.2%). Most of the procedures were performed between 9 and 12 weeks' gestation (47.3%) or before 9 weeks' gestation (39.4%); only 0.2% were performed after 20 weeks' gestation. Suction D&C and insertion of a laminaria tent (preceding an evacuation or induction procedure) were the most common initial procedures (66.3% and 31.5% of cases, respectively). Approximately 85% of the cases in the clinics involved suction D&C, as compared with 57.3% of the cases in the hospitals. A laminaria tent (preceding an evacuation or induction procedure) as the initial procedure was more often used in hospitals than in clinics (39.4% v. 15.0%). Instillation of saline was used only in hospitals (in 0.6% of hospital cases). Instillation of prostaglandins was used in 0.8% of hospital cases and in 0.01% of clinic cases. Table 4 presents the distribution of initial procedures by gestational age.

### COMPLICATIONS

Of the 83 469 abortions 571 (0.7%) were associated with a complication; no maternal deaths were reported. The complications were retained product of conception (313 [54.8%] of cases), hemorrhage (69 [12.1%]), laceration of the cervix (63 [11.0%]), perforation of the uterus (28 [4.9%]), infection (27 [4.7%]) and "other" (unspecified) (71 [12.4%]). Because 98.9% of the patients were released within 1 day and the Abortion Registry Database included only complications occurring at the time of the procedure, we were surprised to see infection coded, since it should not have been detected until 48 hours after the procedure. Of the cases associated with a complication, infection was coded in 22.0% of the clinic cases and 2.7% of the hospital cases. The facilities may have recorded infection if it was already known or if a sexually transmitted diseases (STD) was coded. Since the definition for infection on the standardized forms excludes STDs, we retained cases involving infection in our analysis.

Although performed in few hospitals, instillation pro-

Table 3: Distribution of induced abortions by facility type and gestational age

Facility type	Gestational age, wk						Total
	< 9	9-12	13-16	17-20	> 20	Unknown	
Free-standing clinic	12 195 (37.1)	10 693 (27.1)	2 882 (45.0)	1 266 (56.8)	40 (19.8)	6 (0.3)	27 082 (32.4)
Teaching hospital	9 276 (28.2)	13 797 (34.9)	2 518 (39.3)	692 (31.1)	118 (58.4)	1 001 (43.9)	27 402 (32.8)
Nonteaching hospital	11 398 (34.7)	15 000 (38.0)	1 000 (15.6)	269 (12.1)	44 (21.8)	1 274 (55.9)	28 985 (34.7)
Total	32 869 (100.0)	39 490 (100.0)	6 400 (100.0)	2 227 (100.0)	202 (100.0)	2 281 (100.0)	83 469 (100.0)

cedures were associated with higher complication rates than were curettage procedures (Table 5). The complication rate was highest for instillation of saline (42.9%), alone or in combination with a laminaria tent; retained product of conception occurred in 42.3% of these cases and perforation of the uterus in 0.6%. Instillation of prostaglandins was associated with a complication rate of 20.8%; retained product of conception was the most frequent complication (in 16.4% of cases) and hemorrhage the next most frequent (in 3.1%).

The complication rates among the hospital cases by gestational age varied from 0.2% to 0.7% at less than 9 weeks' gestation, 0% to 12.2% at 9 to 12 weeks, 0.1% to 6.8% at 13 to 16 weeks, 0.1% to 65.1% at 17 to 20 weeks, and 0% to 66.7% at more than 20 weeks' gestation. Many of the hospitals with a high overall complication rate had significantly higher complication rates than other hospitals' rates regardless of the gestational age. The type of facility was not an indicator of volume, since no significant relation existed between the number of abortions performed and the size of the hospital.

Table 6 shows the results of the univariate regression analysis. The risk of complications was greatest for women who had a gestational age of more than 20 weeks, underwent abortion involving instillation of

saline or were in a hospital with fewer than 200 beds. A gestational age of 9 to 12 weeks, suction D&C, insertion of a laminaria tent with an accompanying termination procedure, abortion in a large hospital (400 or more beds) and a history of induced abortion were found to have significant protective effects on the risk of complications. The patient's age and a parity of one or more were not significant factors.

The results of the final multiple logistic regression model are in Table 7. After adjustments for patient's age, parity and history of abortion (induced and spontaneous), the factors most strongly related to complications were gestational age, method of termination and type of facility. After adjustments for method of termination and facility type, the risk of complications increased until 20 weeks' gestation, after which it decreased somewhat.

After adjustments for gestational age and facility type, instillation of saline and instillation of prostaglandins were associated with a higher risk of complications than was surgical D&C. Both suction D&C and insertion of a laminaria tent (preceding an evacuation or induction procedure) as the initial procedure were associated with a lower risk of complications than was surgical D&C.

The facility type was an important factor after adjust-

Table 4: Distribution of induced abortions by type of initial procedure and gestational age\*

Type of initial procedure†	Gestational age, wk						Unknown	Total
	< 9	9–12	13–16	17–20	> 20			
Surgical D&C	540 (1.6)	491 (1.2)	17 (0.3)	3 (0.1)	0	8 (0.4)	1 059 (1.3)	
Suction D&C	24 643 (75.0)	27 196 (68.9)	1 758 (27.5)	153 (6.9)	12 (5.9)	1 546 (68.0)	55 308 (66.3)	
Instillation of saline	0	5 (0.0)	64 (1.0)	217 (9.9)	34 (16.8)	4 (0.2)	324 (0.4)	
Instillation of prostaglandins	2 (0.0)	2 (0.0)	87 (1.4)	237 (10.8)	61 (30.2)	62 (2.7)	451 (0.5)	
Insertion of laminaria tent	7 675 (23.4)	11 793 (29.9)	4 471 (69.9)	1 592 (72.3)	95 (47.0)	652 (28.7)	26 278 (31.5)	
Total	32 860 (100.0)	39 487 (100.0)	6 397 (100.0)	2 202 (100.0)	202 (100.0)	2 272 (100.0)	83 420 (100.0)	

\*Data on initial procedure missing for 49 abortions.

†As in Table 1, the initial procedure includes all components.

Table 5: Incidence of immediate complications from induced abortions by trimester and type of initial procedure

Initial procedure*	Trimester; % (and no.) of abortions with immediate complications	
	First n = 72 347	Second n = 8 820
Surgical D&C	1.2 (12/1 031)	15.0 (3/20)
Suction D&C	0.4 (198/51 839)	0.6 (11/1 923)
Instillation of saline	60.0 (3/5)	42.9 (135/315)
Instillation of prostaglandins	0.0 (0/4)	21.6 (83/385)
Hysterotomy	—	5.3 (1/19)
Insertion of laminaria tent	0.3 (64/19 468)	0.7 (41/6 158)

\*As in Table 1, initial procedure includes all components.



ments for gestational age and initial procedure. There was a higher risk of complications associated with abortions performed in a teaching hospital than with those performed in a clinic. Among the nonteaching hospitals, those with fewer than 200 beds were associated with the highest risk of complications.

## DISCUSSION

Although our findings were based on Ontario data, we believe that they are generalizable to other provinces because we included all clinic and hospital cases performed in the province and because of the wide variety of cases (e.g., in terms of procedures and gestational

ages). Increasing gestational age, use of instillation procedures and performance of abortion in a hospital with fewer than 400 acute care beds were significant factors associated with an increased risk of complications. After the effects of other variables were controlled for, we found that patient's age, parity and history of abortion (induced and spontaneous) were not significant factors.

Our findings support those of previous studies<sup>4,8</sup> in which increased risk of complications was associated with increased gestational age. Risk was greatest among women whose pregnancies were terminated after 12 weeks' gestation. The risk of complications at 13 to 16 weeks' gestation was almost twice that at 9 to 12 weeks and almost three times that at 17 to 20 weeks. The mul-

**Table 6: Univariate analysis of risk factors for immediate complications from induced abortions**

Factor	% of abortions	Crude OR (and 95% CI)*	p value
<b>Gestational age, wk</b>			
< 9†	39.4	1.0	
9–12	47.3	0.5 (0.41–0.59)	< 0.0001
13–16	7.7	2.1 (1.63–2.61)	< 0.0001
17–20	2.7	16.5 (13.72–19.87)	< 0.0001
> 20	0.2	19.4 (12.46–30.18)	< 0.0001
<b>Initial procedure‡</b>			
Surgical D&C†	1.3	1.0	
Suction D&C	66.3	0.3 (0.26–0.36)	< 0.0001
Instillation of saline	0.4	143.9 (113.22–182.79)	< 0.0001
Instillation of prostaglandins	0.5	45.6 (35.68–58.18)	< 0.0001
Insertion of laminaria tent	31.5	0.5 (0.39–0.60)	< 0.0001
<b>Type of facility</b>			
Free-standing clinic†	32.4	1.0	
Teaching hospital	32.8	1.1 (0.94–1.32)	0.2260
Nonteaching hospital ≥ 400 beds	6.3	0.6 (0.43–0.98)	0.0385
200–399 beds	24.2	1.9 (1.60–2.25)	< 0.0001
> 200 beds	4.2	3.3 (2.57–4.24)	< 0.0001
<b>Patient's age, yr</b>		1.0 (0.98–1.01)	0.3894
<b>Parity</b>			
0†	53.0	1.0	
≥ 1	40.9	1.0 (0.85–1.18)	0.9626
<b>No. of previous induced abortions</b>			
0†	62.1	1.0	
≥ 1	30.4	0.7 (0.59–0.84)	< 0.0001
<b>No. of previous spontaneous abortions</b>			
0†	85.3	1.0	
≥ 1	6.7	1.0 (0.76–1.21)	0.7137

\*OR = odds ratio, CI = confidence interval.

†Comparison group.

‡As in Table 1, initial procedure includes all components.

tivariate regression analysis showed that the method of termination and the type of facility were strong confounders for gestational age above 20 weeks. Since late abortions are highly technical and specialized procedures, other factors such as experience of providers, back-up facilities and the availability of more advanced equipment may have contributed to the decreased risk. Our findings differ from those of Jacot and associates,<sup>10</sup> who found that the risk of complications associated with second-trimester abortions was not higher than that associated with first-trimester abortions. However, they examined abortions performed under local anesthesia in one clinic by a small number of physicians, whereas we included all cases in Ontario.

Compared with surgical D&C, both suction D&C and insertion of a laminaria tent (preceding an evacuation or induction procedure) were the safest procedures. Instillation procedures were associated with the highest complication rates, instillation of saline being the strongest risk factor when gestational age and type of facility were controlled for. We did not expect the reporting of instillation methods, given clinical evidence against their use.<sup>4,5</sup> Perhaps the training, experience and choice of the provider affected the method selected. Facility policy may also have affected practice.

After the other variables in the regression model were

controlled for, the risk of complications was found to be greater for women who had an abortion in a hospital, especially one with fewer than 400 acute care beds, than for those who had an abortion in a clinic. Several factors may contribute to these findings. Although the Abortion Registry Database did not include comorbidity data, abortion clinics may see fewer complicated cases than hospitals; however, we cannot verify this. One could expect that teaching hospitals and larger hospitals have the cases with the most significant risk factors; however, these facilities had lower complication rates than did the smaller hospitals. The lower complication rates in the clinics and large hospitals may mean that physicians in these facilities performed abortions more regularly and had more experience, or performed abortions under more optimal conditions (e.g., availability of appropriate diagnostic tools), than physicians in smaller hospitals did. In addition, general anesthesia could be a confounder in hospital abortions, since clinics never use it and some hospitals do. Neuroleptic or general anesthesia may be appropriate care for managing complicated cases. Unfortunately, the provincial database did not include data on type of anesthesia. Finally, the complication rate may reflect surveillance bias, since all of the clinic patients as compared with 93.8% of the hospital patients were outpatients. Without chart audits we do not know the number of hours of care. However, surveillance bias is an unlikely explanation of the differing complication rates among the hospitals.

Our finding that the woman's age, parity and history of abortion were not significant risk factors differs from that of other studies.<sup>9,13</sup> Buehler and coworkers<sup>9</sup> used multivariate regression analysis to examine the effects of risk factors, but they did not include procedural data and they included cases from only 13 facilities. We used both procedural data and gestational age, and we included all abortions performed in Ontario. Grimes, Schulz and Cates<sup>13</sup> examined the effects of several factors on uterine perforation and concluded that a history of deliveries was a significant risk factor. However, they included only cases of curettage procedures and uterine perforations.

Our study has several limitations. First, the database included records of complications occurring at the time of the procedure and therefore could not provide information on complications that may have emerged later. Serious complications such as hemorrhage, sepsis, peritonitis and embolic phenomena may occur after discharge and would not be represented in our dataset.

Second, we do not know whether all physicians code complications similarly. However, a standard list of complications was included as part of the form for reporting complications. Our finding that no patient had a subsequent procedure without having had a reported compli-

**Table 7: Multivariate analysis of risk factors for immediate complications from induced abortions**

Characteristic	% of abortions	Adjusted OR* (and 95% CI)
<b>Gestational age, wk</b>		
< 9†	39.4	1.0
9-12	47.3	1.3 (1.02-1.63)
13-16	7.7	2.5 (1.81-3.54)
17-20	2.7	3.3 (2.23-5.00)
> 20	0.2	2.2 (1.20-4.04)
<b>Initial procedure‡</b>		
Surgical D&C†	1.3	1.0
Suction D&C	66.3	0.4 (0.26-0.67)
Instillation of saline	0.4	24.0 (13.22-43.70)
Instillation of prostaglandins	0.5	11.7 (6.43-21.18)
Insertion of laminaria tent	31.5	0.3 (0.19-0.52)
<b>Type of facility</b>		
Free-standing clinic†	32.4	1.0
Teaching hospital	32.8	1.9 (1.38-2.58)
Nonteaching hospital ≥ 400 beds	6.3	1.1 (0.63-1.74)
200-399 beds	24.2	3.1 (2.27-4.21)
< 200 beds	4.2	5.9 (4.04-8.64)

\*Adjusted for other variables in model.

†Comparison group.

‡As in Table 1, initial procedure includes all components.



cation from the initial procedure supports the advantage of the standard form.

Third, it is possible that all procedures performed in a physician's office or in a private clinic, such as the insertion of a laminaria tent, may not have been included in the database. However, because the same physician likely performed the subsequent procedure, we have no reason to believe that the procedures were underreported. Also, cases of infection reported by some facilities may have been the result of information gained several days after the procedure, and only some facilities may have recorded them.

## CONCLUSION

The overall rate of immediate complications associated with induced abortions in Ontario in 1992 and 1993 was very low. Nevertheless, some of the risk factors for immediate complications may be avoided. Abortions performed in a timely fashion and the avoidance of instillation procedures will reduce the complication rate. Since unavoidable factors such as the woman's age, parity and abortion history were not found to be risk factors for immediate complications, perhaps they need not be considered in the process of care or reflected in the referral pattern.

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## References

1. Hakim-Elahi E, Tovell HMM, Burnhill MS: Complications of first-trimester abortion: a report of 170,000 cases. *Obstet Gynecol* 1990; 76: 129-135
2. Grimes DA, Schulz KF, Cates W Jr et al: Mid-trimester abortion by dilatation and evacuation: a safe and practical alternative. *N Engl J Med* 1977; 296: 1141-1145
3. Grimes DA, Schulz KF: Morbidity and mortality from second-trimester abortions. [review] *J Reprod Med* 1985; 30: 505-514
4. Cates W Jr, Schulz KF, Grimes DA et al: The effect of delay and method choice on the risk of abortion morbidity. *Fam Plann Perspect* 1977; 9: 266-268, 273
5. Peterson WF, Berry FN, Grace MR et al: Second-trimester abortion by dilatation and evacuation: an analysis of 11,747 cases. *Obstet Gynecol* 1983; 62: 185-190
6. MacKay HT, Schulz KF, Grimes DA: Safety of local versus general anesthesia for second-trimester dilatation and evacuation abortion. *Obstet Gynecol* 1985; 66: 661-665
7. Grimes DA, Schulz KF, Cates W Jr et al: Local versus general anesthesia: Which is safer for performing suction curettage abortions? *Am J Obstet Gynecol* 1979; 135: 1030-1035
8. Henshaw SK: Induced abortion: a world review, 1990. *Fam Plann Perspect* 1990; 22: 76-89 [erratum in *Fam Plann Perspect* 1990; 22: 114]
9. Buehler JW, Schulz KF, Grimes DA et al: The risk of serious complications from induced abortion: Do personal characteristics make a difference? *Am J Obstet Gynecol* 1985; 153: 14-20
10. Jacot FRM, Poulin C, Bilodeau AP et al: A five-year experience with second-trimester induced abortions: no increase in complication rate as compared to the first trimester. *Am J Obstet Gynecol* 1993; 168: 633-637
11. Ferris LE, McMain-Klein M: Small-area variations in utilization of abortion services in Ontario from 1985 to 1992. *Can Med Assoc J* 1995; 152: 1801-1807
12. Altman DG: *Practical Statistics for Medical Research*, Chapman & Hall, New York, 1991: 340-345
13. Grimes DA, Schulz KF, Cates WJ Jr: Prevention of uterine perforation during curettage abortion. *JAMA* 1984; 251: 2108-2111

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